Veloce 50

Fiber Optic Temperature Monitor

User Guide
MAN-00029 R7

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NWNAD-05/01/2004

IMPORTANT SAFETY INSTRUCTIONS

This symbol appears on the identification label at the back of the unit. It refers to important safety notices that can be found in this manual

When using any electrical appliance, basic safety precautions should be followed, including the following:

For indoors uses ONLY
Do not operate in wet/damp conditions
Do not operate in an explosive atmosphere
Keep product surfaces clean and dry

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1 GETTING STARTED

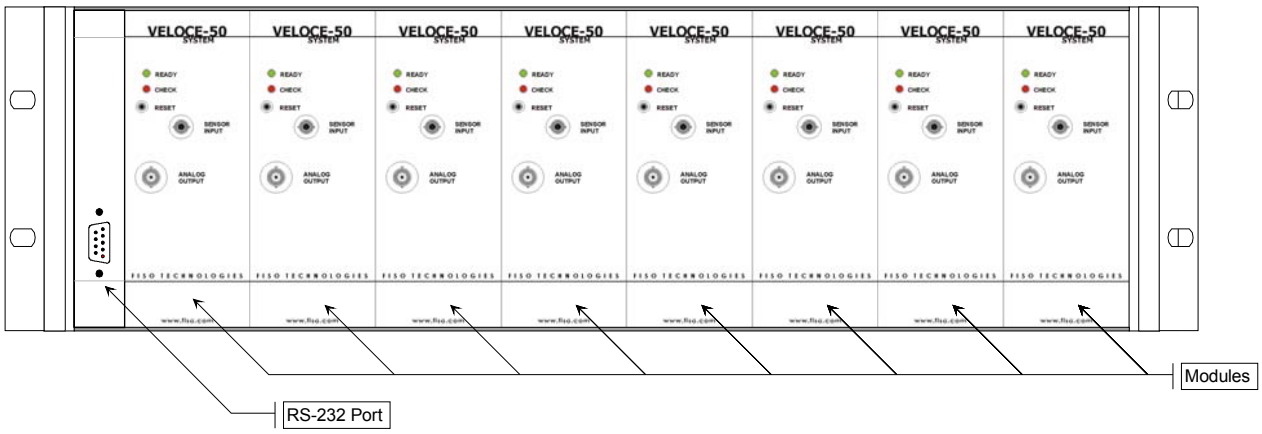
The *Veloce* System is a high-speed and universal fiber-optic signal conditioning instrument that can be used to perform relative Strain, Temperature, Force & Load, and Pressure measurements in hostile locations that were formerly inaccessible with other measuring instruments. The *Veloce* System is an expandable instrument that can accept up to eight *Veloce* plug-in modules. Each *Veloce* conditioner has a 200 kHz sampling speed. The following sections explain how to operate the *Veloce* System.

1.1 QUICK START

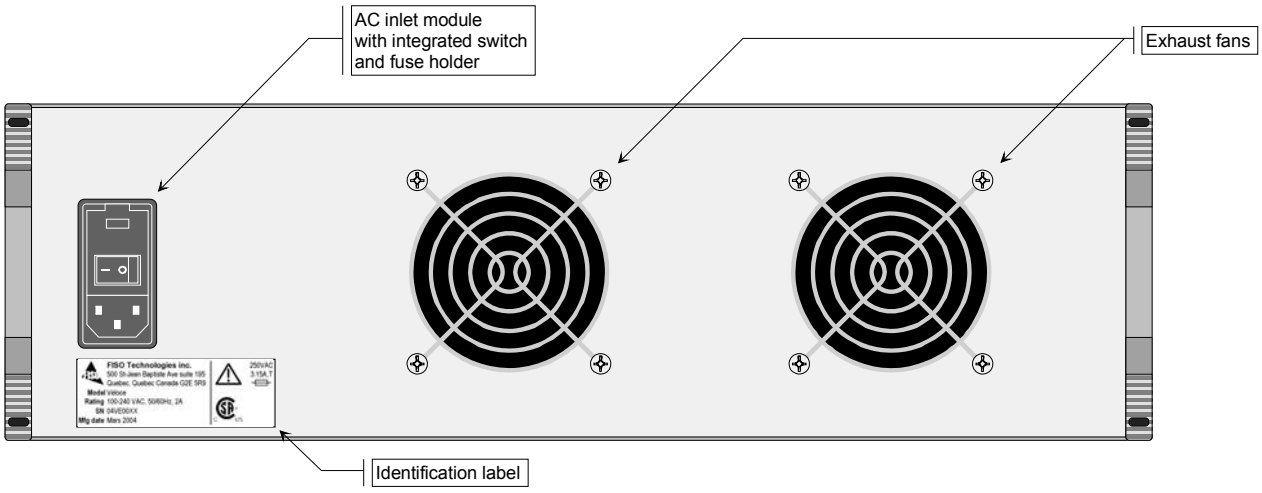
- Power on the *Veloce* System (let it heat-up for one hour for optimum performances);
- Plug a fiber optic transducer in the Transducer Input port of the *Veloce* module;
- Press the reset button;
- Plug the Analog output port to an oscilloscope or to a data acquisition system;
- Read section 6 of this manual to know how to convert the voltage output to a physical value;
- That's it!

2 DESCRIPTION OF THE VELOCE SYSTEM

2.1 FRONT



2.2 BACK



2.3 MODULE FRONT PANEL

The *Veloce* Module front panel essentially consists of the fiber optic Transducer (sensor) Input connector (ST type), the Analog (voltage) Output connector (BNC type), a Reset Button and two (green and red) Status LEDs.

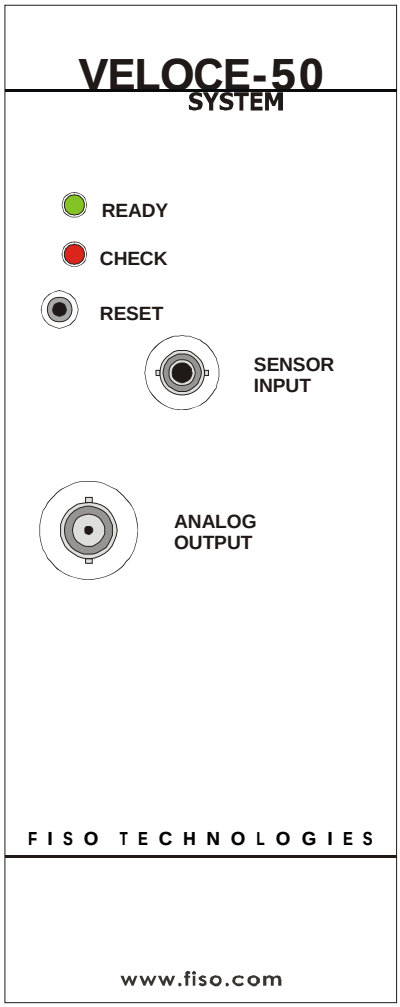


Figure 1. Veloce module front panel overview

2.3.1 STATUS LED

The green LED (READY) indicates that the *Veloce* is currently acquiring and processing data. The red LED (CHECK) is turned on while the reset is activated, or indicates a malfunction of the system.

2.3.2 TRANSDUCER INPUT

The fiber optic transducer connects to the *Veloce* Module via the ST-type fiber optic connector. See section 7.3 for the precautions that have to be taken when mating a transducer to the *Veloce* Module.

2.3.3 ANALOG OUTPUT

The analog output gives a voltage proportional to the value of the physical parameter measured by the fiber optic transducer. The analog output is a BNC-type coaxial connector. See section 6 for converting the voltage output value to the measured physical parameter value.

2.3.4 RESET BUTTON

The Reset Button zeroes out the analog output of the *Veloce* Module. **The «Reset» button has to be pressed each time a transducer is connected to the Transducer Input**. When the Reset Button is pressed, all reference to the previous measurements is lost, thus making the Veloce a **relative** measurement instrument. The *Veloce* module takes approximately 1 second to settle after the Reset Button has been pressed.

3 INSTALLATION

3.1 LINE POWER CONNECTION

1. Check to see that the line voltage is within the limits specified above;

CAUTION: Operating the instrument on an incorrect line voltage may cause damage to the instrument, possibly voiding the warranty.

2. Before plugging in the power cord, make sure that the power switch is in the off (0) position;
3. Connect the female end of the supplied power cord to the AC receptacle on the rear panel. Connect the other end of the power cord to a grounded AC outlet;

WARNING: The power cord supplied with the *Veloce* System contains a separate ground wire for use with grounded outlets. When proper connections are made, instrument chassis is connected to power line ground through the ground wire in the power cord. Failure to use grounded outlet may result in personal injury or death due to electrical shock.

4. Turn on the instrument by setting the power switch on the rear panel to the on (1) position. The Green Status LED indicator will lit up on each *Veloce* module approximately 1 second after power up, showing that it is working and that acquisition and processing has started.

Either the power cord or the AC mains switch are used as disconnecting device; make sure that they remain accessible at all time after installation of the unit

3.2 COOLING AND INSTALLATION

The *Veloce* SYSTEM is cooled by forced convection. Two exhaust fans located on the rear panel allow ambient air to flow outside the chassis of the instrument. The ambient air is drawn inside the casing from the ventilation louvers located on the bottom cover to the fans.

CAUTION: The *Veloce* System chassis must be installed in area where ambient temperature does not exceed 40°C. Enough space must be allowed for exhaust fans and ventilation louvers so they are not obstructed and sufficient ventilation is provided. Operating the instrument with improper cooling may cause damage to the instrument, possibly voiding the warranty.

4 TAKING MEASUREMENTS

4.1 MATING THE TRANSDUCERS TO THE VELOCE CONDITIONER

To use a transducer with the *Veloce* conditioner, simply mate the fiber optic transducer connector with the *Veloce* input connector. Once the transducer is connected, simply press the reset button and valid readings of the transducer will be present at the Analog Output connector. **See section 6 for converting the voltage output value to the measured physical parameter value.**

For proper use of the fiber optic transducers, the transducer fiber optic connectors must be kept clean and free of dust at all times. Any dust may obstruct the light transmitted from one connector to the other, and reduce the signal-to-noise ratio to an unusable level. **IT IS A GOOD PRACTICE TO ALWAYS CLEAN THE TRANSDUCER CONNECTOR BEFORE MATING IT TO THE CONDITIONER (SEE SECTION 6).** Transducer connectors are cleaned by wiping its end with low lint tissue such as Kimwipes® or lens cleaning tissue. Keeping the transducer connectors clean also prevents the contamination of the *Veloce* input connector. However, it is also recommended to clean the *Veloce* input connector once in a while. Use the specially designed 2.5 mm Mini Foam Swab provided with Fiso Cleaning Kit (Part n° FTI-M) for cleaning the input connector of *Veloce*.

4.2 USING THE FIBER-OPTIC TRANSDUCERS

Additional information are available on specific fiber-optic transducers. Ask for Fiso Technologies specific technical note and installation guide such as **Fiso *Fiber-Optic Strain Gauge Installation Guide***.

5 CONDITIONER–TRANSDUCER OPERATION

This section contains important information for the proper operation of the *Veloce* conditioner. It is recommended to read this section before using the *Veloce* for the first time.

5.1 GAGE FACTOR

Each of Fiso fiber optic transducer is delivered with a Gage Factor specified on the storage box and on the sensor itself, near the connector. This Gage Factor is used for all Fiso's line of signal conditioners to tell the instrument the type of measurement and the conversion parameters related to the given fiber optic sensor.

5.2 STRAIN GAGE – CONVERSION FACTOR

The Gage Factor for a strain gage has 7 digits that can be expressed as 1XSSSSS. The first digit of all strain gages is usually equal to 1, but it may also be equal to 5 for temperature compensated strain gages. The second digit (X) has no role to play other than to differentiate strain gages with similar gage length. The last five digits (SSSSS) are representative of the gage length and thus of the sensitivity, herein represented as

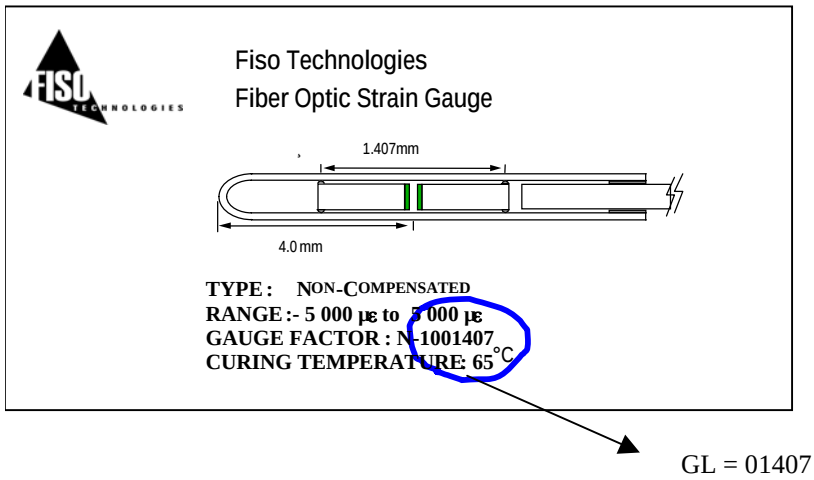


Figure 2. Gage Length given by last five digits

6 THEORY OF OPERATION

6.1 FABRY-PÉROT FIBER OPTIC STRAIN GAGES

All of Fiso Technologies' strain gages are designed around a Fabry-Pérot interferometer (FPI). Basically, an FPI consists of two mirrors facing each other. The space separating the mirrors is called the cavity length. Light reflected from the FPI is wavelength-modulated in exact accordance with the cavity length. As shown in Figure 3, the Fabry-Pérot cavity contains mirrors deposited on the tips of two multimode optical fibers inserted inside a microcapillary. When bonded to a specimen, the strain transferred to the gage is converted into cavity-length variations; the strain is calculated according to the following equation:

$$Strain = \frac{\Delta L_{Cavity}}{L_{Gauge}} \quad (1)$$

where ΔL_{Cavity} is the variation of the cavity length and L_{Gage} is the gage length, i.e. the distance separating the spots where the optical fibers are welded to the microcapillary. It is worth noting that the long-term reliability of the gage length is guaranteed by the quartz-to-quartz welding method which avoids any creep. The sensing part of the gage is located within the gage length area. The sensitivity of the gage is adjusted at the factory by varying the gage length, also defined as the scale factor. The key to the successful use of FPI technology is to find a practical way of obtaining precise cavity-length measurements. The Fiso Veloce System can measure the cavity length with a typical resolution of 5 nm (nanometers).

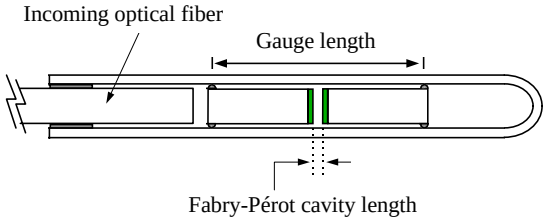


Figure 3 Non-compensated strain gage

It is important to note that the incoming fiber which brings light to the gage is mechanically decoupled from the strain sensitive optical fibers. This design makes the cavity length of Fabry-Pérot gages—and consequently, strain measurements taken with them—virtually insensitive to any pulling or manipulation of the incoming fiber. This design is especially advantageous when the gage is embedded in composite materials.

Fiso strain gages make use of standard 50/125 µm multimode optical fibers.

6.2 PRINCIPLE OF THE VELOCE SIGNAL CONDITIONER

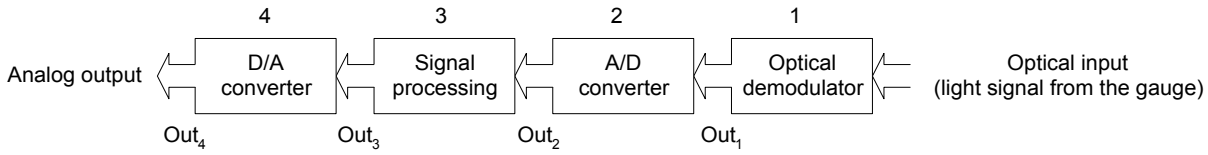


Figure 4 Schematic of the operation of the *Veloce*

Light from the gage is fed into the optical demodulator. The analog output signal of the demodulator Out_1 is then sampled by the analog-to-digital converter at the specified sampling rate (this is the sampling rate that is specified with the conditioner, i.e. like 200 kHz). The digital output signal Out_2 is then processed by a digital signal processor (DSP). The digital output signal Out_3 is then fed into the digital-to-analog converter and then send to the analog output.

The signal coming out of the optical demodulator, Out_1, is a sinusoidal function of the time-dependent cavity length of the gage:

$$Out_1(t) = A \times \sin[2\pi \times L_{Cavity}(t) / VSF] \qquad (2)$$

where A and VSF (the *Veloce* Scale Factor) are constants which are characteristics of the conditioner. The VSF typically ranges from 420 nm to 430 nm. The VSF is individually calibrated for each *Veloce* module and is programmed into its flash memory. The DSP takes the VSF into account in the calculations so that 1 mV at the analog output always corresponds to 2 nm of gage cavity length.

The *Veloce* conditioner can read the gage cavity length L_{Cavity} in a range that goes from13 µm to 19 µm, or 13 000 nm to 19 000 nm. Outside these limits, the amplitude of the signal (the A factor) becomes too small to lead to precise calculations.

Eq. (2) shows that the maximum frequency of Out_1 is proportional to the rate of change of the cavity length. In other words, for a strain gage, it is proportional to the **strain rate**. And because of the *Veloce* proprietary signal processing algorithm, one has to ensure that the maximum change of the cavity length between two samples of the A/D converter must never exceed one half of the VSF, i.e. approximately 200 nm per sampling interval. In résumé one can say that the frequency bandwidth of the *Veloce* signal conditioner is mostly limited by the strain rate, that is the variation of strain with time. However, for small signals (maximum excursion lower than VSF / 2), the signal bandwidth is limited to the Nyquist criterion of half the sampling rate of the *Veloce* (i.e. 100 kHz).

6.3 RELATIVE VERSUS ABSOLUTE MEASUREMENTS

All of Fiso' FTI, UMI, DMI and BUS series of fiber-optic conditioner are absolute measurement conditioners as opposed to relative measurement conditioners. However the *Veloce* series of conditioners offered by Fiso Technologies are **relative** measurement conditioner. The differences between these two types of conditioner are explained in the next paragraphs.

6.4 ABSOLUTE MEASUREMENT CONDITIONER

Absolute measurement means that the data readings — which are the results from the conditioning of the sampled signal of the transducer — are absolute or true measurement values of the physical stimulus (strain, pressure, etc.). One important consequence of using absolute measurement conditioner is that there is no loss of the true reference (or initial state) of the transducers when the conditioner is turned OFF or reset.

6.5 RELATIVE MEASUREMENT CONDITIONER

Relative measurement means that the data readings — which are the results from the conditioning of the sampled signal of the transducer — are measurement values relative to an initial or reference value of the physical stimulus. One important consequence of using relative measurement conditioner is that it is not possible to recover the true reference or initial value of the transducers when the conditioner is turned ON or is reset. Because the initial value of the transducer is not known, a common practice is to set the output of the conditioner to zero each time it is turned OFF or is reset.

Figure 5 shows the basic consequence of using a relative measurement conditioner. The first graph of the figure is the absolute or true strain values versus time as it would be measured using an absolute measurement conditioner. The graph of example 1 shows the measured strain values using a relative measurement conditioner started at an initial time t_0 (i.e. t_0 is the time at which the conditioner is tuned ON or is reset) The graph of example 2 is same as example 1 except that the measurements are started at a different initial time t_0. In both cases the measured strain values are relative to the initial value of the transducer at time t_0 but because the initial state of the transducer is different at these two times, the relative strain value differs too.

The relative strain value is expressed by the following equation:

$$\varepsilon_r(t) = \varepsilon(t) - \varepsilon(t_0)$$

where: $\varepsilon_r(t)$ is the relative strain as fonction of time
$\varepsilon(t)$ is the absolute or true strain as fonction of time
$\varepsilon(t_0)$ is the absolute or true strain at time t_0

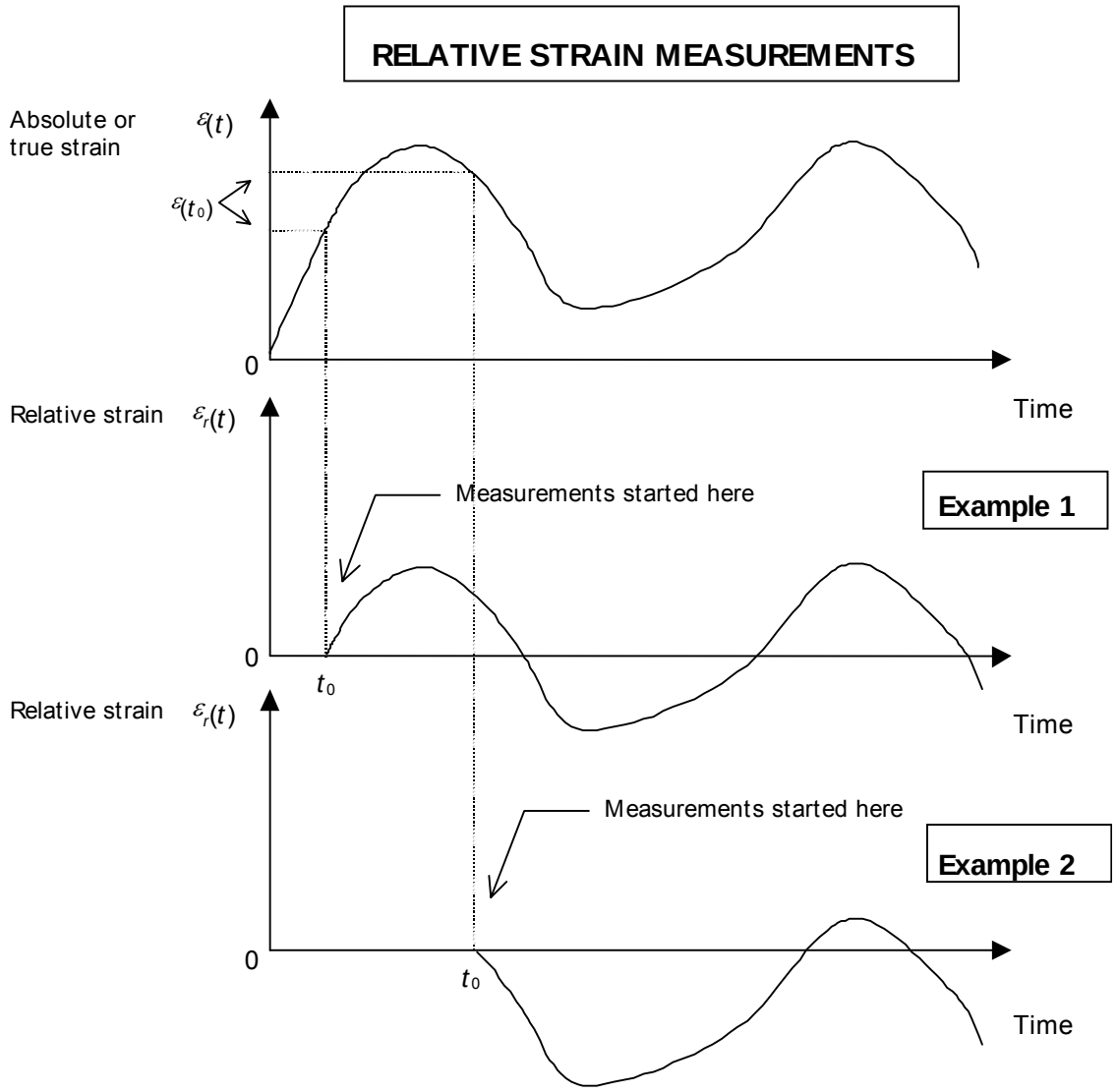


Figure 5. Schematic explanation of relative measurements.

7 MAINTENANCE

7.1 REPLACING THE FUSE

A rear panel fuse located next to the power receptacle protects the power line input of the instrument. If the line fuse needs to be replaced, performs the following steps:

WARNING: Make sure the instrument is disconnected from the AC line and other equipment before replacing the line fuse.

1. Pull out the fuse holder located next to the power receptacle, at the rear of the instrument;

2. Remove the fuse and replace it (see specifications for fuse type and rating);

CAUTION: For continued protection against fire or instrument damage, only replace fuse with the type and rating listed. If the instrument blows fuses repeatedly, contact factory or your local distributor.

3. Install the fuse holder by pushing it until it locks in place.

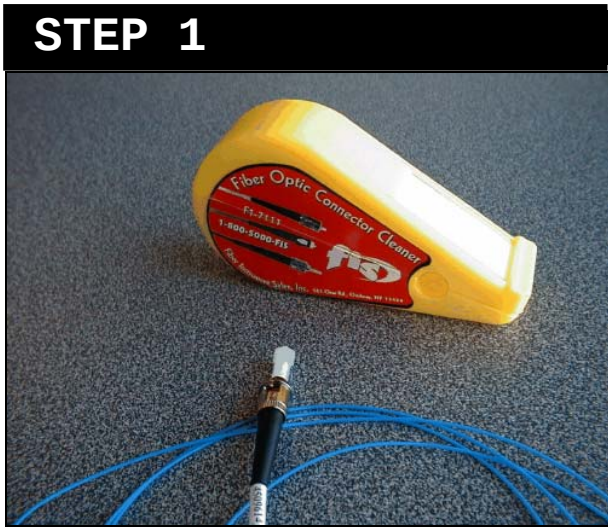
7.2 CONNECTOR CLEANING PROCEDURE

7.2.1 INFORMATION ON GENERAL FIBER-OPTIC APPLICATIONS

In order to properly maintain your system, here are some advices that FISO Technologies suggests to its fiber-optic customers. The optical connection between a transducer and a conditioner is made via a mating sleeve and two connectors. These two connectors are: the transducer's connector and the conditioner's internal connector. In order to properly carry the light signal, the connectors are in physical contact with each other. Due to this physical contact, presence of fingerprints or grease laying on a connector surface may contaminate other connectors. As any application involving fiber-optic connectors, it is important that the connectors remain clean.

7.2.2 HOW TO CLEAN THE TRANSDUCERS AND CONDITIONER CONNECTORS

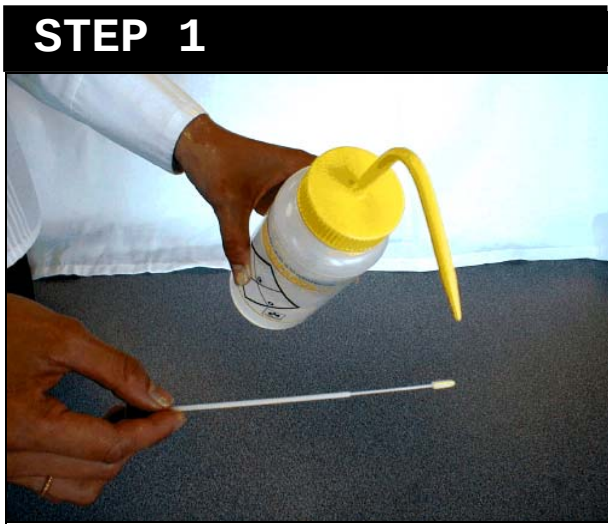
Transducer connector



FISO Technologies recommends cleaning the connector via the use of FISO Fiber Optic Connector Cleaner. To do so, ensure a new cleaning surface by advancing cloth tape. Tear off excess tape as required.

Softly press connector and expose it to the cloth with motion illustrated in above figure. Up to 6 connectors may be cleaned before advancing tape.

Conditioner internal connector



Provided in the cleaning kit, swab sticks are required to insure a proper cleaning technique. Please do not use cotton swabs. Swabs sticks are available at most electronic store. Take a swab and pour a few drops of isopropanol on it (avoid acetone).

While rotating, smoothly insert the swab in the internal connector of your conditioner. Then rotate the swab in order to swamp the entire internal connector surface. Repeat step #1-2, 3 times and always use new swabs sticks. To prevent scratches on the connector, always use soft tip swab stick

.

7.3 HOW TO PREVENT DAMAGE AND ENSURE A LONG LIFE TO YOUR TRANSDUCERS

Here is a list of point forms that will help the user to prevent damages and ensure long life to his transducers. If you are working with a team or if it is the first time you are working with fiber-optic devices, it is a good idea to use this page as a reminder at your application location.

- Keep the fiber-optic connector surface clean.
- When the transducer is not in use, always plug a protective cap on the connector.
- Avoid allowing fiber-optic connectors to drop or scrape on hard surfaces.
- Avoid sharp radius turns in the fiber-optic cable (radius less than 10 mm).
- Avoid tension or twisting of the fiber-optic cable.
- Avoid pinch points and “scissors” when setting in place the transducer.
- Do not pull on fiber-optic cable to clear tangles; carefully unwind instead.
- If you are spooling the fiber, verify that the tie wraps or metal ties remain loose.
- When installing the transducer try to avoid bending force or shear force on the transducer tip.
- The strain transducer external sheathing must be kept clean until it is bonded. The transducer should be protected to prevent grease, dust or dirt exposure.

If you have any questions, please do not hesitate to contact us at FISO Technologies. Our customer support will be more than please to help you.

7.4 PREVENTIVE MAINTENANCE

7.4.1 INSPECTION

The unit should be inspected regularly to detect wear, damage or missing parts and to ensure that the mounting screws or brackets do not work loose.

The power cord should be inspected as well to ensure that the female part is clean of dirt or any other substance that could otherwise become conductive or hazardous, that the male terminals do not show sign of crack, bend or corrosion and that the plastic insulation is not damaged.

Any non-conformity detected on the unit or the power cord should be reported immediately to your responsible body or to FISO's Technical Support Team.

7.4.2 CLEANING

The unit should be cleaned regularly to avoid excessive build-up of dust or any other potential contaminant.

To clean the unit, use a soft cloth dampened with soaped water; make sure that no liquid drips from the cloth that could introduce moisture inside the unit.

If you have any questions, please do not hesitate to contact us at FISO Technologies. Our customer support will be more than pleased to help you.

8 SPECIFICATIONS

General	
Number of channels:	1 to 8
Compatibility[1]:	Compatible with all of FISO's line of fiber-optic transducers (limited use with FOD sensor)
Sampling rate:	200 kHz
Averaging:	0.005 ms to 100 ms
Precision:	0.3% of full scale
Resolution[2]:	0.1% of full scale
Dynamic range[2]:	3 000 : 1
Data logging:	None
Communication:	RS-232 communication port for system setup
Analog outputs:	BNC ± 5 Volts
Upgradability – firmware:	Flash ROM Upgradable
Upgradability – channels:	Plug-in modules from 1 to 8 channels for one chassis
Weight:	Chassis: 7.5 Kg Channel module: 0.5 Kg
Enclosure dimensions (WxDxH):	450 x 360 x 132.5 mm

1: Except displacement transducers

2: Without averaging

Electrical Supply	
Voltage Range	100-240Vac
Frequency	50/60Hz
Current:	2 A

Fuses	
Type	5mm x 20mm glass tube fuses
Rating	250VAC , 3.15A , T
Part number	GDC-3.15A from Bussmann

Environmental conditions	
Altitude	5000 M max
Operating temperature:	0°C to 40°C (32°F to 104°F)
Humidity	80%RH @ 31°C decreasing linearly to 50%RH @ 40°C
Mains supply voltage fluctuation	± 10%
Installation category	II
Pollution degree	2

APPENDIX A COMMUNICATION VIA RS-232 PORT

8.1.1 CONVERSION FROM VOLTAGE TO DEGREES CELCIUS

The temperature is obtained by multiplying the analog output span (AP^f), the voltage output (mV) and the calibration factor (CF).

$\Delta T = CF * AP^f * \Delta V$

Variable	Example		Sources
CF	1.012 ^oC/nm	*Note1	Calibration Factor, written on each sensor box.
AP^f	0.01 nm/mV	*Note1	Analog Span ^{f}, stored in the conditioner memory.
ΔV	3000 mV		Voltage output, measured by the user at the conditioner front panel (Analog output).
ΔT	30.36 ^oC		

***Note1:** «nm» stands for nanometers, which are FISO Technologies internal units. By multiplying CF and AP together the nanometers units cancel out to leave an ^oC/mV scale factor.

Each of Fiso fiber optic temperature transducer is delivered with a Calibration Factor designated both on the storage box and on the calibration sheet. The Calibration Factor of each probe can be retraced using the serial number affix on the connector which also appears on the storage box and calibration sheet.

By default, the *Veloce* voltage output span (AP^f) is scaled at 0.01nm/mV.

8.1.2 ADJUSTABLE PARAMETERS (REMOTE CONTROL)

Parameters of importance like signal averaging and voltage output span can be modified remotely via the RS-232 port. Other functions like resetting the system and getting access to the versions of hardware, software and calibration date are also accessible remotely.

8.1.2.1 Voltage output span

The analog output span can be adjusted to meet the dynamic range required to resolve both small and large temperature variations. The span is defined as the total cavity length change per 5Volts. By default, the span is set at 50nm/5V. Considering the probes sensitivity is of about 1 nm/^{o}C, the system will be able to measure a temperature change limited to 50^{o}C. The command [APXXXXX] is used to adjust the span, where XXXXX is the total cavity length change per 5V.

8.1.2.2 Signal averaging

Resolution improvement is achieved by averaging the input signal. The *Veloce* always make acquisition of the photo-detectors (input signals) at a rate of 200 kHz. The output rate is determined by the time constant. A time constant set at 0.001s corresponds to a refreshing rate of 1/0.001 s = 1 kHz. For the same time constant, the number of averaged samples is obtained by multiplying the time constant minus 0.000005 by 200 000Hz (e.g. (0.001s – 0.000005) × 200 000 Hz = 199 samples). Time Constant is adjustment with the command [TC0.ssssss], where the parameter 0.ssssss is the time constant in second.

8.1.2.3 System reset

The system can be reset by switching system off and on, by pushing the reset button, or by using the command [RS].

8.1.2.4 Zeroing

The command [AZ0] will add a 0V offset to the analog output as specified by the parameter but **does not** reset the system. For zeroing the sensor **without** resetting the system then use the command [ZO].

8.1.2.5 Versions

Calibration date, serial number, and firmware and hardware versions can be obtained using the commands [DC], [SN], [VR] and [VB], respectively.

8.1.3 REMOTE CONTROL

8.1.3.1 Hardware settings

The RS-232 serial connection to the *Veloce* is made through a DB-9 connector located on the front of the rack mount chassis. The *Veloce* is equipped with a RS-232 internal switch to give access to each module from one single RS-232 serial link.

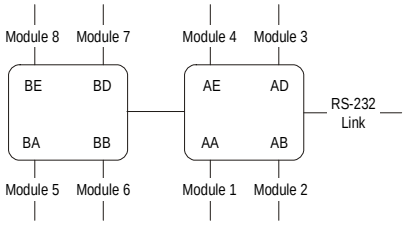
If your computer is equipped with a DB-9 serial port connector, then use a standard RS-232 extension cable (all wires straight through). If your computer is equipped with a DB-25 connector, use a DB-25 to DB-9 converter module with a standard RS-232 extension cable. **NOTE: do not use a null modem cable or adapter.** The serial link must be configured as follow:

BAUD RATE:	9600
PARITY:	NONE
DATA BITS:	8
STOP BIT:	1

8.1.3.2 Hardware flow control

The *Veloce* makes use of hardware flow control Handshaking based on RTS/CTS control. When activated, the Request To Send (RTS) line of the serial link informs the *Veloce* that the UART of the host computer or controlling instrument is ready to exchange data (=Computer Ready). The Clear To Send (CTS) line indicates, when activated, that the *Veloce* is ready to exchange data (= *Veloce* Ready).

8.1.3.3 RS-232 Switches



The *Veloce* is equipped with two cascaded RS-232 switches to give easy access to any of the eight plug-in modules from one single RS-232 connector (Figure besides). It is required to first establish the link between the DB-9 connecting port and the module with which the communication needs to be established. Once the communication is established, then commands can be sent and received between the host computer and the selected module. The switch looks continuously for a four character code by monitoring the data that is being received from the host computer. The switch requires a four-character preamble code to turn on and off a port. The first character must be the ASCII escape character (decimal 27). The second character is the ASCII character STX (decimal 2). The third and fourth characters are used to select the port associated to the proper module. The commands required to establish the connection to each module are given in the table below. Once the connection is established, the Remote Control Commands are sent to the selected module and data are received from as long as the switch doesn't catch a new command for establishing a new connection.

Selected Module n°	ASCII switching command	Keyboard switching command
1	ESC STX AA	ESC Ctrl B AA
2	ESC STX AB	ESC Ctrl B AB
3	ESC STX AD	ESC Ctrl B AD
4	ESC STX AE	ESC Ctrl B AE
5	ESC STX BA	ESC Ctrl B BA
6	ESC STX BB	ESC Ctrl B BB
7	ESC STX BD	ESC Ctrl B BD
8	ESC STX BE	ESC Ctrl B BE

Fiso Technologies provides software that emulates the HyperTerminal software with commands that allow easy connection to a specific communication port, as well as easy channel switching.

8.1.3.4 Remote Control Commands

All the Remote Control Commands can be sent to the *Veloce* by using simple communication software (such as HyperTerminal on Windows 95® or higher version). These commands can also be used with programs made with BASIC, C/C++ compilers, or with third party software such as ASYST or LAB-VIEW.

All Remote Control Commands begin with a two letter (capital letter) identifier referred to as the prefix of that command. Commands without argument are composed solely of their prefix. **All commands must start with a left bracket ([ ) and end with a right bracket ( ]) to be interpreted correctly.** These two characters are the delimiters of a command. Everything typed inside the bracket is considered to be part of the command. Whenever a command must be followed by an argument, the command prefix and the argument are strung together. The *Veloce* does not interpret a command until the right delimiter is encountered in the incoming flow of characters. Everything between the brackets is sent back over the serial link as soon as the right delimiter is encountered. In other words, all the commands sent to the *Veloce* are echoed back to the computer. Each line of characters returned to the computer by the *Veloce* terminates with a line feed (`\n`) and carriage return (`\r`) character.

Example: The command **[ZO]** returns the reading to 0. Upon reception of the command, the *Veloce* returns the following over the serial link: ZO`\n\r`. The following table gives the list of remote control commands.

REMOTE CONTROL COMMANDS	
COMMAND NAME	**SYNTAX**
ANALOG OUTPUT	
ANALOG SPAN **	**[APXXXXX], [AP]**
ANALOG ZERO	**[AZXXXXX], [AZ]**
READINGS PARAMETERS	
ACQUISITION AVERAGE **	**[TC0,ssssss], [TC]**
ZEROING SENSOR	**[ZO]**
DIAGNOSTIC REPORT	**[DR]**
MISCELLANEOUS	
HARDWARE VERSION	**[VB]**
SOFTWARE VERSION	**[VR]**
CALIBRATION DATE	**[DC]**
SERIAL NUMBER	**[SN]**
SYSTEM RESET **	**[RS]**

** : These commands will reset the system

\n = LINE FEED character
\r = CARRIAGE RETURN character
\t = TAB character

8.1.3.5 Analog Output

[AP] Analog Span

NAME:	**ANALOG SPAN**
SYNTAX:	**[AP**XXXXX**]** or **[AP]**
PARAMETERS:	XXXXXX is the wanted span (positive integer). The parameter corresponds to the cavity length change per 5000 mV (fixed value). As example, [AP**50**] corresponds to **50**nm/5000 mV = 0.01nm/mV. If none: Return the current value of the span. For conversion purpose, we define also 0.01 nm/mV factor as AP^f.
REMARKS:	This command is used to set the SPAN of the analog output. Used without parameter, this command returns the actal span value stored in the conditioner.
RETURN VALUE:	APXXXXX\n\r ;Echo "***** Quitting the expert mode *****" (or) AP\n\r ;Echo XXXXX\n\r XXXXX is the current value of the span.
ERROR NUMBER:	10

[AZ]: Analog Zero

NAME:	**ANALOG ZERO**
SYNTAX:	**[AZ**XXXXX.XX**], [AZ]**
PARAMETERS:	XXXXX.XX is a positive or negative number that sets the *ZERO* (*Analog Offset*) on the analog output. XXXXX.XX is the value in physical units of the 0Volts position. Values must be comprised between -20 000 à 20 000. If none: returns the current *ZERO* (*Analog Offset*) value from the analog output.
REMARKS:	It is not recommended to use this command with a parameter other than 0.
RETURN VALUE:	AZXXXXX.XX\n\r (or) AZ XXXXX.XX\n\r (XXXXX.XX is the current *ZERO* value from the active channel analog output)
ERROR NUMBER:	10

8.1.3.6 Reading Parameters

[ZO] Zeroing sensor

NAME:	**ZEROING SENSOR**
SYNTAX:	**[ZO]**
PARAMETERS:	*None*
REMARKS:	This command returns the reading to 0.
RETURN VALUE:	ZO\n\r
ERROR NUMBER:	None

[TC] Acquisition average

NAME:	**ACQUISITION AVERAGE**
SYNTAX:	**[TC0**.ssssss**], [TC]**
PARAMETERS:	*0.ssssss is a positive number in second that sets the* Averaging Time*.* *Mode Fast :* 5 µS *Minimum averaging :* 25 µS *Step value :* 10 µS *Example :* 5, 25, 35, 45 µS If none: returns the current value of the *Averaging Time*
REMARKS:	
RETURN VALUE:	TC0.ssssss\n\rEcho "***** Quitting the expert mode *****" (or) TC\n\r 0.ssssss\n\r (where 0.ssssss is the current *Averaging Time)*
ERROR NUMBER:	*10*

NAME:	**DIAGNOSTIC REPORT**
SYNTAX:	**[DR]**
PARAMETERS:	None
REMARKS:	This command provides information regarding the status of the unit. The return value will be use by members of the technical support team to diagnose eventual malfunction of the system.
RETURN VALUE:	********** ALL LEDS OFF ********** s0=792.3 100.01% s1=832.6 100.00% s2=818.1 100.05% ********** LED 2 ON ********** s0=12328.4 101.57% s1=11016.1 101.01% s2=15008.4 102.01% ********** LED 1 ON ********** s0=4453.8 NA s1=3901.8 NA s2=5066.0 NA
ERROR NUMBER:	None

8.1.3.7 Miscellaneous

[RS] System Reset

NAME:	**SYSTEM RESET**
SYNTAX:	**[RS]**
PARAMETERS:	*None*
REMARKS:	This command Reset the DSP as do the front panel button
RETURN VALUE:	RS\n\r Echo "***** Quitting the expert mode *****"
ERROR NUMBER:	None

[DC] Calibration Date

NAME:	**CALIBRATION DATE**
SYNTAX:	**[DC]**
PARAMETERS:	*None*
REMARKS:	This command returns the calibration date and time
RETURN VALUE:	DC\n\r YY-MM-DD\tHH:mm\n\r YY: for the year MM: For the month DD: For the day HH: For the hour mm: for the minutes
ERROR NUMBER:	*None*

[SN] Serial number

NAME:	**SERIAL NUMBER**
SYNTAX:	**[SN]**
PARAMETERS:	*None, this command returns the serial number of the conditioner*
REMARKS:	
RETURN VALUE:	SN\n\r XXXXXX\n\r where XXXXXX is the serial number
ERROR NUMBER:	None

[VR] Firmware version

NAME:	**FIRMWARE VERSION**
SYNTAX:	**[VR]**
PARAMETERS:	*None, this command returns the EPROM version.*
REMARKS:	
RETURN VALUE:	VR\n\r X.Y.Z\n\r (where X.Y.Z is the EPROM version)
ERROR NUMBER:	None

[VB] Hardware version

NAME:	**HARDWARE VERSION**
SYNTAX:	**[VB]**
PARAMETERS:	*None, this command returns the hardware version.*
REMARKS:	
RETURN VALUE:	VB\n\r VELOCE XXXXXX\n\r (where XXXXX is the Hardware version)
ERROR NUMBER:	None

8.1.3.8 Remote Special Commands

NAME:	**MODULE SWITCHING COMMAND FOR HYPERTERMINAL**
SYNTAX LEGEND:	**A & B => press A and B at the same time**.
SYNTAX:	**Press ESCAPE key** **«Control» & B** **XX** **«Enter»**
PARAMETERS:	AA (for module 1)....capital letters AB (for module 2) AD (for module 3)....not AC! AE (for module 4) BA (for module 5) BB (for module 6) BD (for module 7) BE (for module 8)
REMARKS:	This command is used to access a specific *Veloce* module.
RETURN VALUE:	None